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Autographic Indicator for Tension Tests

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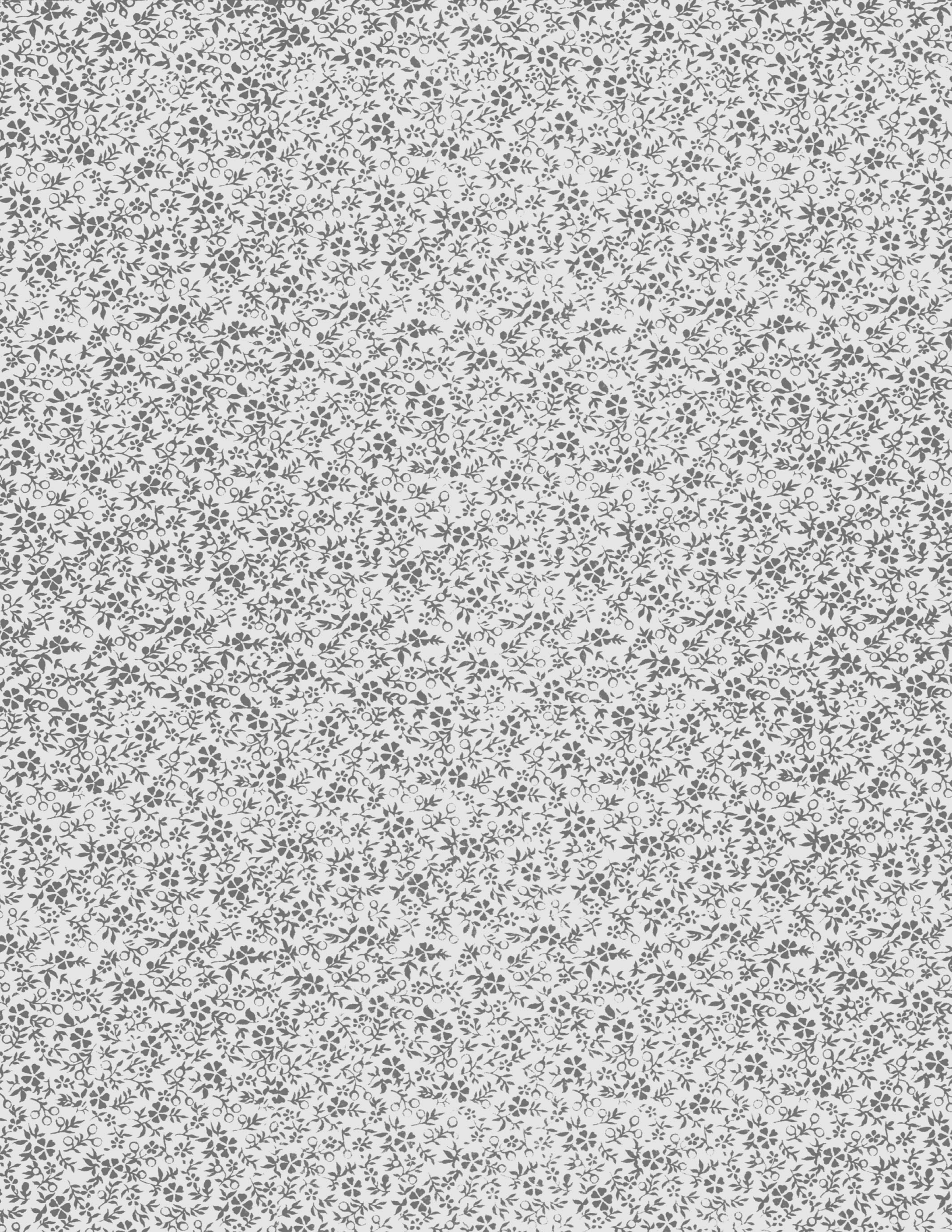


Autographic Indicator for Tension Tests.

The Object of this Thesis is the design and construction of an autographic indicator for tension tests of metals for use with the Tinius Olsen 100,000 pound testing machine of the testing laboratory of Kansas University.

An examination of available data in regard to autographic indicators for tension tests reveals two classes of devices. The first class containing devices which have parts of the recording device fixed to some part of the testing machine of disconnected entirely. The second class, including all recording devices connected only to the test piece. The first class is inaccurate because distortions in the frame of the testing machine itself, enter into the autographic record. Examples of the first class may be found in "Handbook of Testing Materials" by Adolf Martens, two volumes. In the second class, the indicators, being fastened securely to the test piece, show more accurate results. One of the best of this type is the Henning Pocket Indicator, described in A.S.M.E. Records Vol. XX, Page . This indicator is applicable to almost any machine but some error is introduced by the use of a cord, fastened to poise fo revolve the drum, because the machine may be disturbed and the cord may stretch.

The requirements of a good autographic indicator are, First. The autographic record should not be affected by any distortions of the indicator itself, or by any distortions of the testing machine with which it is used.

Second. The scales, to which the record is made should be as large as possible so as to magnify both the elongation and stress of the piece.

Third. It would be convenient to have an indicator which could be used for both tension and compression tests and which could be applied to any machine.

Discription of Indicator as designed for this thesis.

(See blue-print)

The two clamps C_2, C_4, and C_3 are clamped to the test piece by cup pointed screws S, mounted in brushings and held against test piece by flat springs, The rods U, fastened to the lower clamp slide inside of tubes T, fastened to the upper clamp, and keep the clamps in a plane perpendicular to the axis of the test piece and also allow the clamps to separate when the test piece elongates In closed position centers of ~~stress~~ Screws S are 8 inches apart. The support M fastened to the lower clamp C_3 supports the shaft A of the drum D. This drum should preferably be made of aluminum ~~wood~~, and be as light as possible. A rod R, is fastened to upper clamp C_1 by means of a clamp and nut C_5. To the lower end of R, is rivited a Rack, R having 16 teeth to the inch. The rack R meshes with the pinion G_3, which has16 teeth. The pinion G_2 is mounted on the shaft E, the bearings of shich are fastened to the lower clamp C_3.

The gear G_4 having 254 teeth, is also pinned to shaft E. Gear G_1, meshes into Gear G_2, of 40 teeth, which is pinned to shaft A of drum D. Circumference of drum is 7 7/8 inches equals 63/8in.

When clamps C_2 and C_3 have separated one inch gear G_1, makes one revolution, and at same time gear G_2 and drum D make 254-40 revolutions, or 254-40 x 63-8 inches equals 50 inches on the circumference of the drum. (more nearly 50.006 inches)

The ratio of elongation is therefore 50 to 1.

The drum D was limited to about 5 inches available length.

The capacity of above testing machine is 100,000 lbs. which would give 20,000 pounds per inch, a scale which is too small.

Because of this, four pens are arranged to travel consecutively over the length of the drum. Pen, P_4 to register 0 to 25,000 pounds, P_3, 25,000 pounds to 50,000 pounds and so on. Pens as shown on blue print are in their final position. The stress scale is thus made 5,000 pounds per inch of paper. Each pen as P_1. is fastened to a barrel B which slides on the rod H.

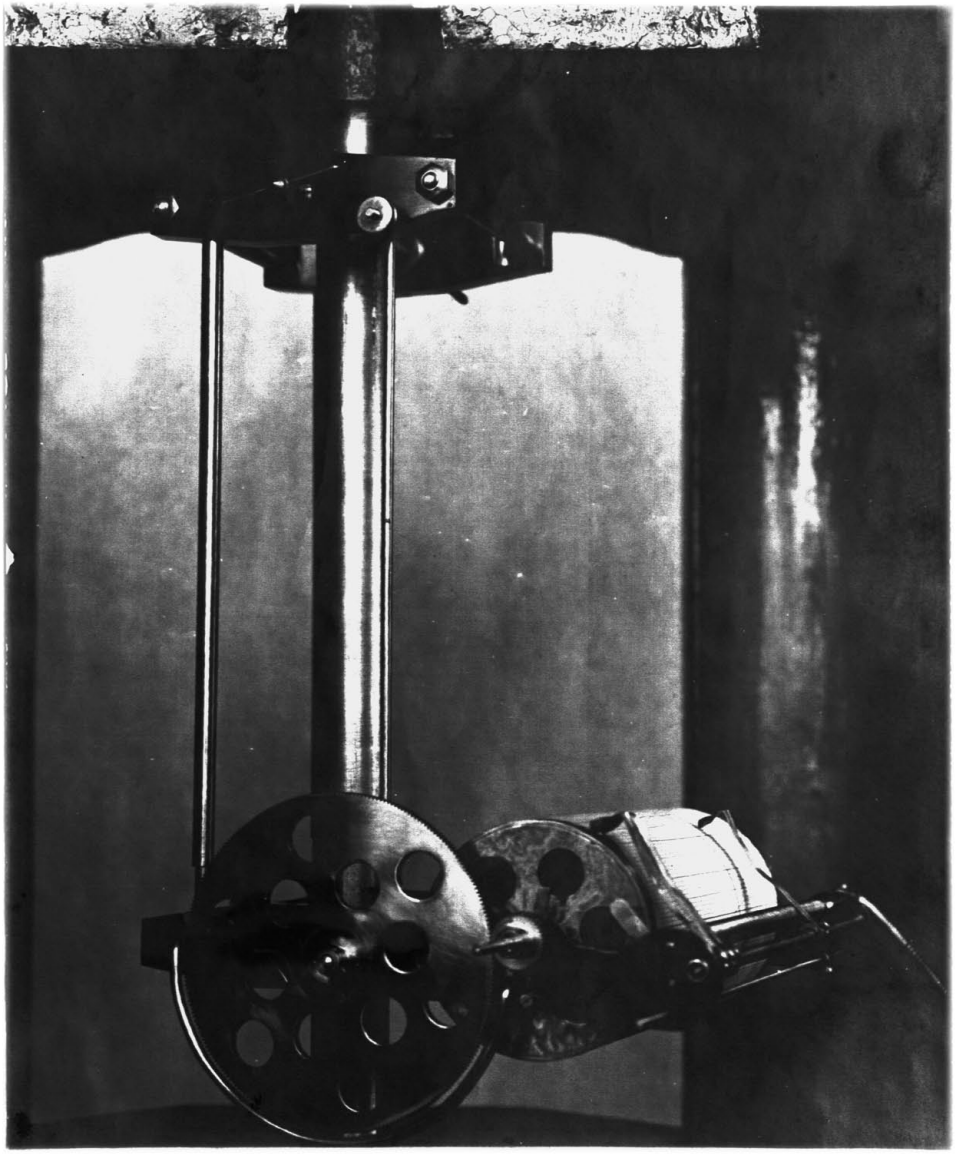
Each barrel has a lug K, which reaches into the threads of lead screw L. When one pen has traveled across the drum the next pen is fed into the lead screw by the feeders F_1 and sliding rod J.

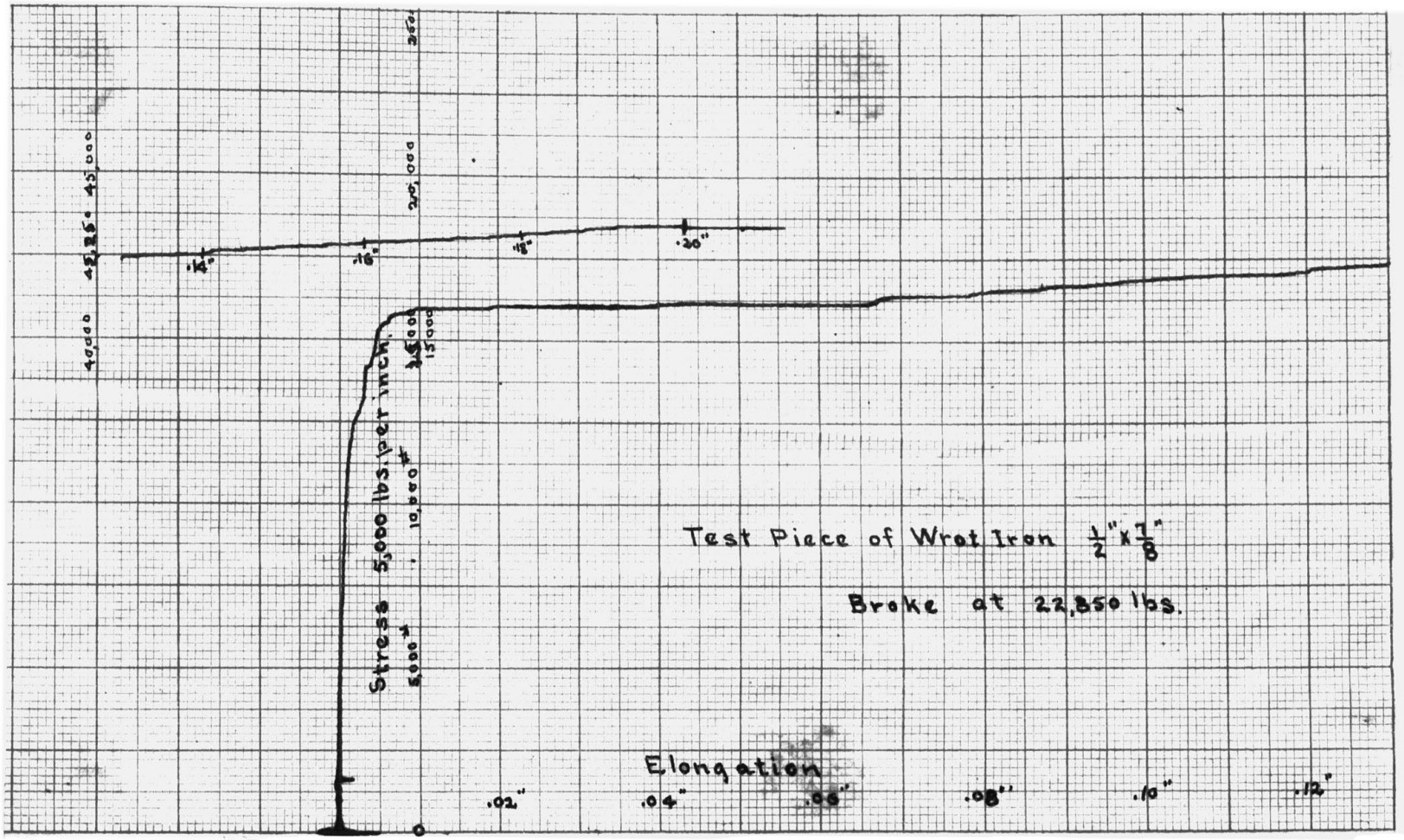
The lead screw L has 20 threads per inch and hence must make one revolution per 250 pounds increase of stress. The weight registering dish of the testing machine makes one revolution per 2,000 pounds, and has 144 teeth in its rim; therefore a gear having 18 teeth, if meshed with above dish, will make one revolution per 250 pounds. The shaft of this last gear is connected by a flexible shaft to the end L_1, of lead screw L. A universal coupling might be used here but would be more likely to injure the indicator in case of any binding of parts. The cam C releases

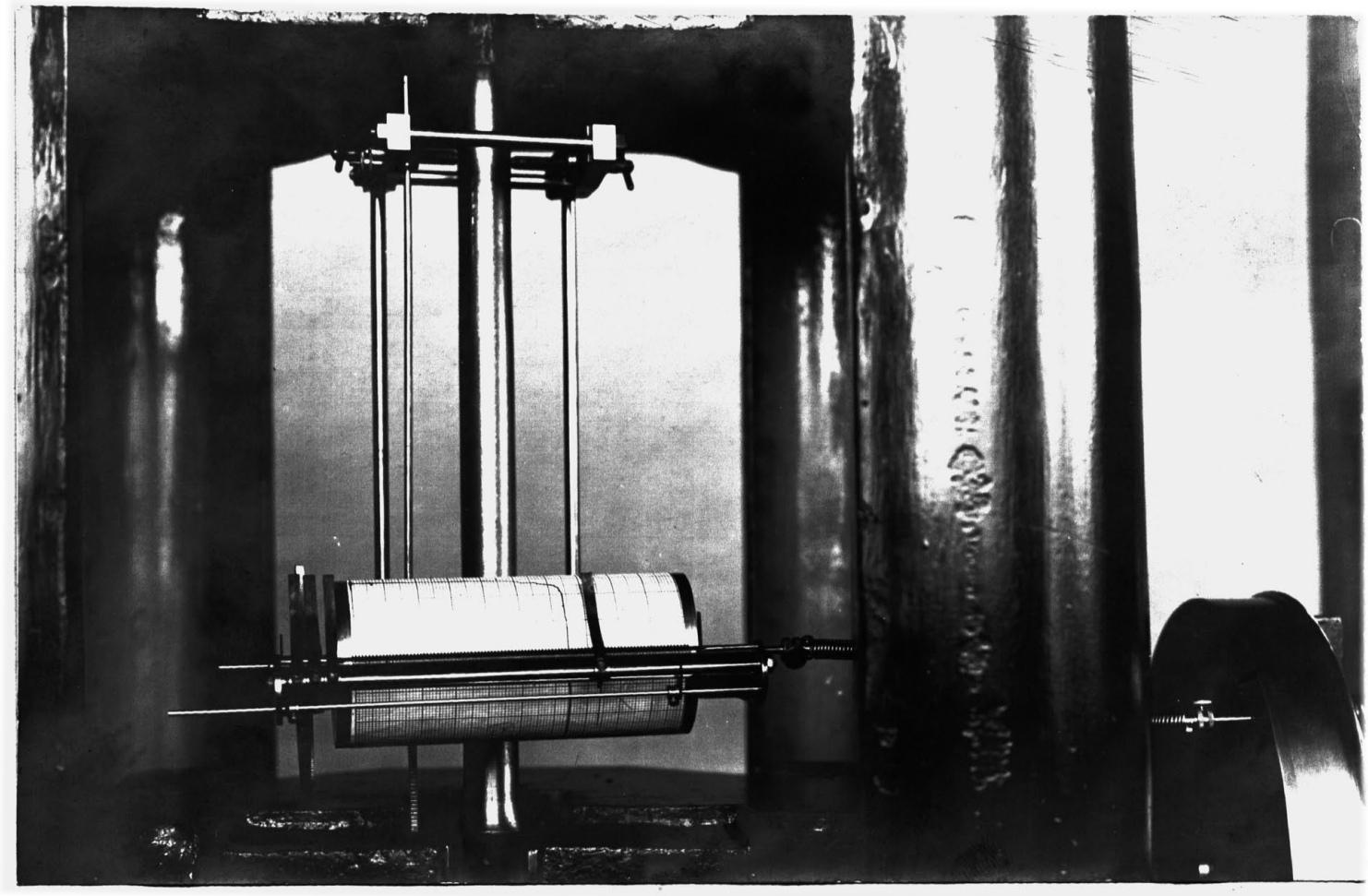
the pressure of the pens against the drum when the drum is to be removed.

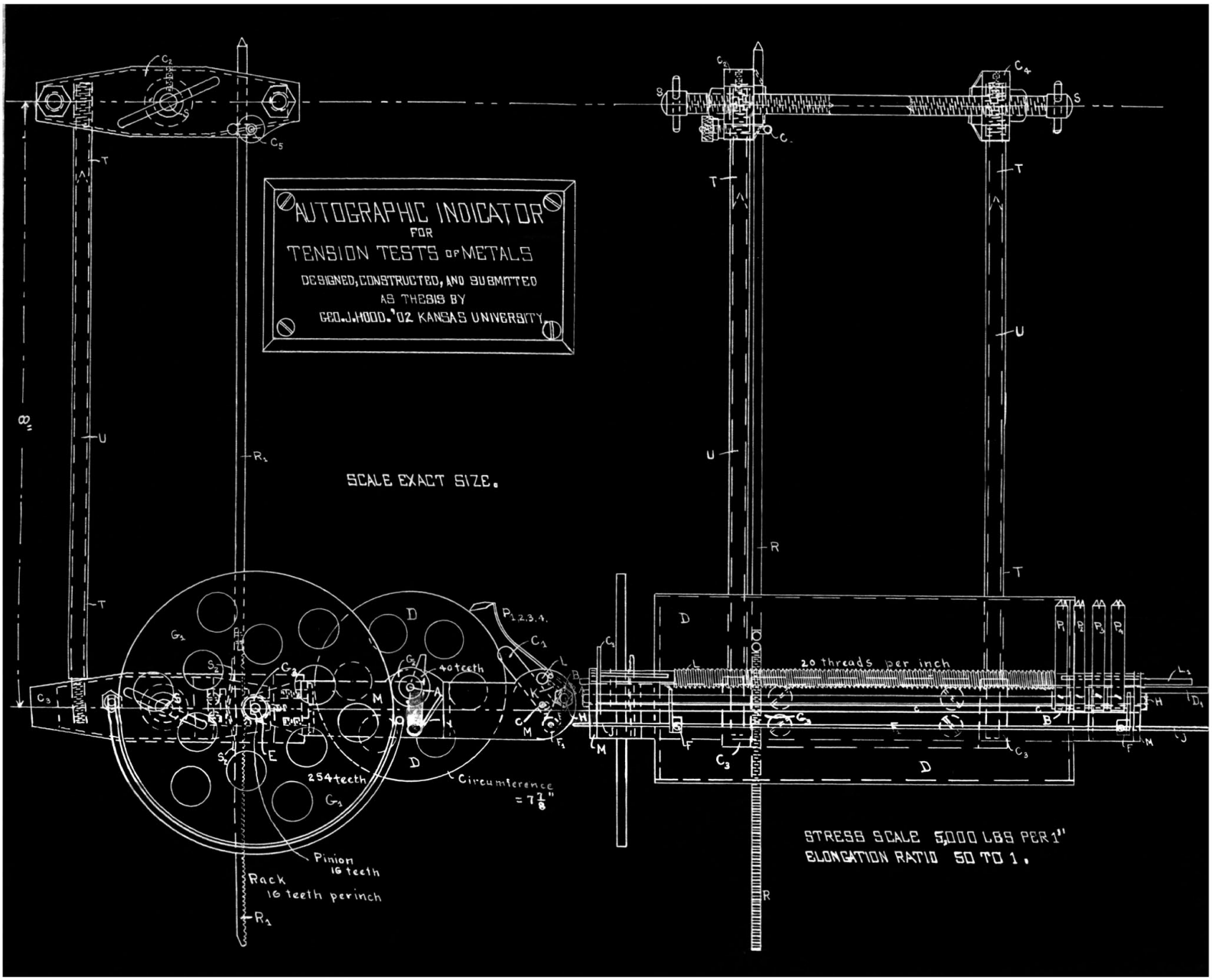
Back of the rack R is placed a spring S_2 to allow the rack R to slip away from pinion G_3 in case of breaking of test piece. It is not advisable, however, to break the test piece while the indicator is fastened to it.

The drum is slotted to admit the ends of the cross section paper and a clamp holds the paper securely in place.




Test Piece of Wrot Iron ½" x ⅞"
Broke at 22,850 lbs.
Stress 5,000 lbs. per inch.
Elongation
.02"
.04"
.06"
.08"
.10"
.12"
.20"
0




AUTOGRAPHIC INDICATOR
FOR
TENSION TESTS OF METALS
DESIGNED, CONSTRUCTED, AND SUBMITTED
AS THESIS BY
GEO. J. HOOD. '02 KANSAS UNIVERSITY
SCALE EXACT SIZE.
8"
20 threads per inch
40 teeth
254 teeth
Circumference = 7 7/8"
Pinion 16 teeth
Rack 16 teeth per inch
STRESS SCALE 5,000 LBS PER 1"
ELONGATION RATIO 50 TO 1.